

AN ASSESSMENT OF  
CLINICAL DECISION MAKING SKILLS  
ACROSS A PHYSICAL THERAPY CURRICULUM

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by Margaret Susan Cigelman  
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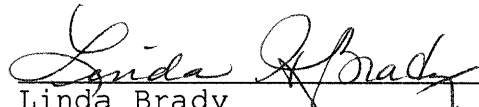
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An abstract of a Dissertation by  
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The problem. Physical therapy faculty state as an objective that graduates will be competent in clinical decision making. As students progress through the curriculum, and out into the profession, clinical decision making skills should increase. The problem is assessing these skills. The purpose of this research was to assess the clinical decision making of students across a curriculum.

Procedures. The participants were four physical therapy classes (162 students). For the study, the Class of 1994 was one year post-graduation, the Class of 1995 had just graduated, the Class of 1996 had completed half of the curriculum, and the Class of 1997 had just enrolled in the program. The Class of 1997 was retested after two semesters. The Clinical Decision Making Scale (CDMS) (Jenkins, 1985) was administered to the students. The CDMS consisted of 40 items designed to measure the decision-making process. The scale yielded a total score and four subscale scores.

Findings. No significant differences were found between CDMS total scores for the four classes. The Class of 1995 scored significantly higher on Subscale A (Searching for Alternatives and Options) than the Class of 1997. The Class of 1996 scored significantly higher than the Classes of 1994 and 1997 on Subscale D (Searching for Information and Unbiased Assimilation of New Information). The Class of 1997 exhibited a near significant increase ( $p = .051$ ) in total CDMS scores between enrollment and retesting. There were no significant relationships between CDMS scores and grade point averages (GPA) or clinical instructors' ratings.

Conclusions. (1) Students at different levels of the curriculum did not exhibit differences in overall clinical decision making. (2) Students at different levels of the curriculum did exhibit differences in subsets of clinical decision making. (3) Students exhibited growth in clinical decision making across the first year of the curriculum. (4) Students' clinical decision making could not be predicted from GPA or clinical instructors' perceptions of students' clinical decision making.

Recommendations. Research should be undertaken to gather longitudinal and normative CDMS data on physical

therapy students and graduates to track development over their education and career.



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## Chapter 1

### INTRODUCTION

#### Background of the Study

Physical therapy faculty across the country state as a program outcome objective that graduates will be competent in clinical decision making. Clinical decision making has come to the forefront of the physical therapy profession with the increase over the past ten years in the number of state practice acts that allow physical therapists direct access (without physician referral) to patients. This has resulted in physical therapists having increased responsibilities in the area of decision making.

Physical therapists are responsible for deciding what to include in the assessment of patients, making diagnoses, and deciding whether to treat or to refer patients to other practitioners. If physical therapists decide to treat, we must decide what the treatment plans will be, what treatment to include, and when to discharge patients. (Myers & Rose, 1989, p. 523)

Training in clinical decision making is incorporated by physical therapy faculty throughout the academic curriculum. These skills are difficult to teach, especially in the classroom setting. Hislop (in Wolf, 1985, p. 30) stated "clinical decision making can neither be taught nor learned in the absence of the patient." The academic faculty therefore rely on the students' clinical internship experiences to further develop and refine these very important skills. The success of this combination of

academic and clinical training in clinical decision making is also difficult to assess. At present, there is little evidence indicating that students' experiences in a physical therapy curriculum advance their clinical decision making skills.

The literature has explored decision making from various perspectives. Terminology such as decision making, problem solving, reasoning, judgment and critical thinking have been used interchangeably. Presseisen (in Costa, 1985, pp. 44-48) cited four types of higher-order cognitive processes defined by the outcomes served by each process. These higher order processes are:

Problem Solving - using basic thinking processes to resolve a known or defined difficulty; assemble facts about the difficulty and determine additional information needed; infer or suggest alternate solutions and test them for appropriateness; potentially reduce to simpler levels of explanation and eliminate discrepancies; provide solution checks for generalizable value.

Decision Making - using basic thinking processes to choose a best response among several options; assemble information needed in a topic area; compare advantages and disadvantages of alternative approaches; determine what additional information is required; judge the most effective response and be able to justify it.

Critical Thinking - using basic thinking processes to analyze arguments and generate insight into particular meanings and interpretations; develop cohesive, logical reasoning patterns and understand assumptions and biases underlying particular positions; attain a credible, concise, and convincing style of presentation.

Creative Thinking - using basic thinking processes to develop or invent novel, aesthetic, constructive ideas or products, related to percepts as well as concepts, and stressing the intuitive aspects of thinking as much as the rational.

Emphasis is on using known information or material to generate the possible, as well as to elaborate on the thinker's original perspective. (p. 45)

For decisions to be of high quality, the decision maker must follow a set of decision-making procedures. Janis and Mann (1977) identified seven criteria to determine the quality of decision-making.

The decision maker, to the best of his ability and within his information-processing capabilities

1. thoroughly canvasses a wide range of alternative courses of action;
2. surveys the full range of objectives to be fulfilled and the values implicated by the choice;
3. carefully weighs whatever he knows about the costs and risks of negative consequences, as well as the positive consequences, that could flow from each alternative;
4. intensively searches for new information relevant to further evaluation of the alternatives;
5. correctly assimilates and takes account of any new information or expert judgment to which he is exposed, even when the information or judgment does not support the course of action he initially prefers;
6. reexamines the positive and negative consequences of all known alternatives, including those originally regarded as unacceptable, before making a final choice;
7. makes detailed provisions for implementing or executing the chosen course of action, with special attention to contingency plans that might be required if various known risks were to materialize. (p. 11)

Janis and Mann asserted that failure to meet these criteria during decision-making constituted a defect in the process.

#### Statement of the Problem

"The cornerstone of effective clinical decisions is the ongoing acquisition of knowledge" (Wolf, 1985, p. 380). The academic and clinical settings both play an integral role in

this acquisition of knowledge. In the clinical setting, students have the opportunity to apply and expand upon the knowledge learned in the classroom. Thus, as physical therapy students progress through the didactic and clinical aspects of a curriculum, and out into the professional world, there should be an increase in the level of their clinical decision making skills. The problem is assessing the level of clinical decision making behaviors of physical therapists.

Efforts are being made to develop forms of assessment that are more valid, efficient, and reliable than previous forms of clinical assessment. These assessments include: paper-and-pencil and computer-based patient management problems, written key-issue simulations, the objective structured clinical examination or multiple-station examinations, and standardized patients. Each of these methods has limitations (Newble et al., 1994).

Physical therapy faculty, at various points in a program's curriculum, rely on clinical sites to provide students with experiences which will aid in the development and refinement of decision making skills. Physical therapy faculty are selective in choosing the facilities to which students are assigned for clinical experiences and the qualifications of the clinical instructors at these sites. Each student though, even if assigned to the same facility, will have a different experience. While the academic faculty can control the content of the didactic curriculum, they



have minimal control of the clinical experience in regards to the patient population, the teaching and feedback style of the clinical instructor, or the thoroughness and objectivity of the student's evaluation by the clinical instructor. The academic faculty need to determine if the objectives of the clinical experiences and the didactic curriculum are being met for all students no matter what their experiences are in the clinic.

Evaluation of a student's performance during a clinical experience not only gives an indication of the learning that has occurred in the classroom and clinical setting but can also be an indication of the effectiveness of clinical teaching (Deusinger, 1990). The primary method of evaluation during a clinical experience is direct observation. Wakefield (in Neufeld & Norman, 1985) and Watts (1990) bring to question the reliability of direct observation. Observation of a student's performance can be rushed and fragmentary. Most judgmental steps cannot be observed directly. The clinical instructor must guess the student's mastery on the basis of bits and pieces of performance the clinical instructor can see as well as on what the student reports he or she does.

It has been suggested that ratings of students by clinical instructors add little to the evaluation process. Sloan, Donnelly, Drake, and Schwartz (1995) showed subjective clinical performance ratings did not correlate well with objective tests of knowledge or performance. Most

physical therapy programs use clinical evaluation tools with global rating scales. These rating scales can have poor reliability and validity. Streiner (in Neufeld & Norman, 1985) reported that a student makes an overall impression on a rater that influences all of the ratings contained in an evaluation. Thus, the evaluation gives a global impression rather than feedback in a specific area.

Evaluation of the many behaviors and skills required of a clinician requires more than one method of evaluation. The use of multiple evaluation methods increases the likelihood that the strengths of one method will overcome the weaknesses of another method (McKenzie, 1994). Time, training, and resource constraints preclude the clinical instructor from carrying out multiple methods of evaluation. It is imperative the academic faculty share in the responsibility of evaluating the student's progress over the clinical, as well as the academic phases of the curriculum (Deusinger, 1990).

The faculty's responsibility in evaluation is not only necessary to decrease the burden on the clinical instructor but it is also the academic faculty's responsibility to assure that graduates are achieving the stated program outcomes (Commission on Accreditation in Physical Therapy Education, 1990). Assessment of educational outcomes should be a continuous process designed to provide public accountability, meet accrediting requirements, and improve learning (McKenzie, 1994).

## Purpose of the Study

A significant amount of the literature on clinical decision making skills in the health professions has been on the process, teaching, or utilization of these skills and not on evaluation of skills. The purpose of this cross-sectional and longitudinal study was to assess the level of clinical decision making skills in physical therapy students across a curriculum.

The Clinical Decision Making in Nursing Scale, published and copyrighted by Jenkins (1985) in 1983, was used to measure clinical decision making behaviors. This scale was used in this study to assess the level of clinical decision making behaviors of a group of health care professionals outside the nursing profession. This group was four levels of physical therapy students and graduates (Classes of 1994-1997).

Jenkins (1985) developed the Clinical Decision Making in Nursing Scale (CDMNS) to measure perceptions of clinical decision making. Content validity was established through a pretest and critique, followed by an assessment by a panel of expert nurses. Reliability of the instrument was determined to be .83 using Cronbach's alpha. Jenkins, after initial testing with the scale, revised the answer scale descriptors to reflect behavior rather than perceived ability (Day, 1991).

The CDMNS consists of 40 items designed to measure the decision-making process. The 40 items were determined to be

appropriate for assessing the clinical decision making of anyone in a health related area (Day, 1991). The instrument yields a total score and four subscale scores. The subscales were based on Janis and Mann's (1977) criteria on decision making. The four subscales are:

Subscale A: Search for Alternatives and Options  
(based on criterion 1)

Example of subscale item: If the clinical decision is vital and there is time, I conduct a thorough search for alternatives.

Subscale B: Canvassing of Objectives and Values  
(based on criterion 2)

Example of subscale item: I assist clients in exercising their rights to make decisions about their own care.

Subscale C: Evaluation and Reevaluation of  
Consequences (based on criteria 3, 6, and 7)

Example of subscale item: If a benefit is really great, I will favor it without looking at all the risks.

Subscale D: Search for Information and Unbiased  
Assimilation of New Information  
(based on criteria 4 and 5).

Example of subscale item: Looking for new information in making a decision is more trouble than it's worth. (Jenkins, 1985, p. 224)

Jenkins administered the scale to 111 nursing students across three levels of one program's curriculum. Jenkins expected as students acquired more decision making experiences and skills, they would perceive themselves as making better decisions. No significant differences between the three levels of nursing students were found except in Subscale A, Search for Alternatives or Options. A post hoc analysis determined the differences were between the juniors and seniors.

H. M. Jenkins (personal communications, March 4 and 21, 1995) recommended research with groups outside nursing to refine items on the CDMNS and to establish norms for these groups. Day (1991), in recommendations for further research, suggested administering the CDMNS to different levels of physical therapists to "further delineate the role of experience in clinical decision making and help establish baseline scores for different levels of therapists" (p. 67). H. M. Jenkins (personal communication, March 21, 1995) granted permission to change the name to Clinical Decision Making Scale (CDMS) for the purposes of this study (Appendix A).

For the cross-sectional aspect of this study, the Class of 1994 was one year post-graduation. The Class of 1995 had just completed the entire 24 months of the physical therapy curriculum including 29 weeks of clinical internships. The Class of 1996 had completed 12 of the 24 months of the curriculum including 9 weeks of clinical internships. The Class of 1997 had just enrolled in the curriculum. This class was retested at the completion of one third of the curriculum to obtain longitudinal data. This portion of the curriculum concluded with two weeks of clinical experience.

Scripted verbal instructions for completion of the scale were given to the students at administration of the instrument. Written instructions were mailed to the graduates participating in the study. The CDMS was an

untimed test but usually requires approximately 20 minutes to complete.

A secondary purpose of this research was to determine if a student's overall percentage grade average was an indication of the level of a student's clinical decision making skills. Data was also collected to determine how a clinical instructor's rating of a student's clinical decision making behaviors compared to the student's performance on the Clinical Decision Making Scale.

#### Research Questions

Research questions for this study were:

1. Are there differences in clinical decision making skills between physical therapists who are one year post-graduation, physical therapy students who have just completed a curriculum, physical therapy students who have completed one year of the curriculum, and physical therapy students that are just beginning the curriculum?
2. Is there a difference in clinical decision making skills of physical therapy students between enrollment and completion of one-third of the curriculum?
3. Is there a relationship between the student's level of clinical decision making and the student's overall percentage grade average in the academic curriculum? If there is a relationship, is there enough accuracy in this relationship to predict the student's clinical decision making skills from the overall percentage grade average?

4. Is there a relationship between a clinical instructor's rating of a student's clinical decision making skills and the student's performance on a tool designed to measure this skill? If there is a relationship, is there enough accuracy in this relationship to predict the student's performance on a measure of clinical decision making from the clinical instructor's rating of the student's skills?

5. Is there a difference between student and clinical instructor ratings of the students' clinical decision making skills?

#### Significance of Study

This study was designed to assess the clinical decision making skills of physical therapy students and graduates who had completed various levels of a physical therapy curriculum. This study will guide the faculty of the Program in Physical Therapy at the University of Osteopathic Medicine and Health Sciences in determining whether the physical therapy curriculum is facilitating the development of students' clinical decision making skills. The study may also prove useful in determining the appropriateness of clinical instructors' evaluations of students' clinical decision making skills.

This study may benefit the faculty of other physical therapy educational programs in their evaluation of outcomes. The tool used in this study to assess clinical decision making could be used at other schools to provide

It was not possible to test all four levels of evidence the programs' objectives are being met. This tool could be used at various times throughout the curriculum.

#### Assumptions

The assumptions underlying this study were:

1. Graduates of physical therapy programs need to be able to make sound clinical decisions.
2. The acquisition of professional knowledge is necessary for clinical decision making in physical therapy.
3. Scores on the Clinical Decision Making Scale represent clinical decision making heuristic process ability.
4. The physical therapy students, graduates, and clinical instructors answered questions honestly.
5. The academic grade records were accurate reports of the students' academic performance.
6. All variables were scored and recorded accurately by the researcher.

#### Delimitations of the Study

In this study, the sample was delimited to students from four levels of a physical therapy program. Ages ranged from 21-50 years. Generalizations beyond these four levels or to other physical therapy programs should be made with care.

#### Limitations of the Study

1. Random selection of subjects was not possible. A sample of convenience was used for this study.



2. It was not possible to test all four levels of students at the same time.

3. A high return rate of graduate and clinical instructor questionnaires could not be assured.

4. Time frames limited studying the same group of students over an extended time period.

#### Definition of Terms

Clinical decision making is the process a health professional uses in the clinical setting to make a decision. This includes: using basic thinking processes to choose a best response among several options; assembling information needed in a topic area; comparing advantages and disadvantages of alternative approaches; determining what additional information is required; and judging the most effective response and being able to justify it.

Clinical decision making may be measured by the Clinical Decision Making in Nursing Scale (Jenkins, 1985). For the purposes of this study, this instrument is named the Clinical Decision Making Scale.

Clinical Evaluation consists of formative and summative methods of evaluation used by a clinical instructor to monitor and assess the performance of students in the clinical setting.

Clinical Instructor is a person who works in a health care setting and has primary responsibility for the supervision, teaching, and evaluation of students.

Clinical Setting refers to any of the wide array of environments in which a health care professional may work with patients or clients.

Full-time Clinical Internship is a period of 40 hour work weeks in which a student gains supervised practical clinical experience.

Percentage Grade Average is the average, expressed as a percentage (possible range of 80-100), for all didactic work completed in the physical therapy curriculum.

## Chapter 2

### REVIEW OF THE LITERATURE

#### Introduction

A significant amount of research on clinical decision making has been conducted since the late 1960s. Many of the studies have dealt with the decision making done by physicians. Other studies have been conducted in pharmacy, physical therapy, and nursing.

This chapter covers the general results of the literature search along with a discussion of internal and external validity. A historical perspective of the decision making literature is given followed by a discussion of specific studies on simulations, clinical reasoning, novice versus experienced clinicians, and the Clinical Decision Making in Nursing Scale. The review concludes with a discussion of other studies relevant to this research.

A review of the literature on this topic yielded an inconsistent use of terminology for different thinking skills. This review was guided by the definitions of higher-order cognitive processes cited by Presseisen (in Costa, 1985, pp. 44-48). At times, an article's author stated that clinical decision making skills were being studied when in reality critical thinking was the topic. The opposite was also true. The investigator for this study primarily searched for articles dealing with decision making. Articles dealing with clinical reasoning, problem solving, clinical

judgment, and critical thinking tended to confuse the issue. In a special issue on clinical decision making of the American Physical Therapy Association's edited journal, various authors used decision making in the title and then limited the articles to problem solving or clinical reasoning.

Theories on decision making go back as far as the 1600's. Many books have been written on this topic. The classic work in the field of medicine by Elstein, Shulman, and Sprafka (1978) was titled, Medical problem solving: An analysis of clinical reasoning. (Note the discrepancies in terminology.)

Much of the literature found was in the form of discussion articles dealing with implementation of strategies to teach decision making, the need for these skills, or models for how persons go about making decisions. There did appear to be a trend since 1990 for increased publication of research studies on the assessment of decision making skills.

Results the basis of effects  
General to what we now term the hypothetico-deductive

Efforts are being made to develop forms of assessment that are more valid, efficient, and reliable than previous forms of clinical assessment. These assessments include: paper-and-pencil and computer-based patient management problems; written key-issue simulations; the objective structured clinical examination or multiple-station

examinations; and standardized patients. Each of these methods has limitations (Newble et al., 1994). The studies reviewed were a mix of quantitative and qualitative designs. Many of the studies used written, videotape, or actor simulations. In most cases, sample size was small.

### Validity

The primary threats to internal validity in the studies were selection and instrumentation. Several studies compared the skills of experts and novices in a health profession. These groups could differ on many different characteristics other than the independent variable. Instrumentation though was the major threat. Several studies have shown that simulations in various forms are not valid reproductions of what actually occurs in the clinical setting. Since sample sizes were small in most cases, the external validity of most of the studies was also threatened.

### Historical Perspective

Decision making was discussed in the literature as early as the 1600s. At that time, scientists were increasingly guessing at causes on the basis of effects, according to what we now term the hypothetico-deductive method. At the same time, Descartes felt there were two methods of analysis. One was from cause to effect in which the effect is proved from the cause. The second was from effect to cause in which the effect is explained by postulating a cause. Descartes also believed that hypotheses

served as the basis for deducing true effects but were not themselves to be asserted as true (Hacking, 1980).

Much of the literature on decision making comes from the area of psychology. Bayes Theorem, an algebraic formula described by Reverend Thomas Bayes in 1763, combines probability judgments based on mere hunches with probabilities based on relative frequencies when making decisions. The Bayesians introduced intuitive judgments and feelings directly into the formal analysis of a problem (Raiffa, 1968). This model is considered to be normative in that it provides for how people should make decisions (Bell, Raiffa, & Tversky, 1988). In general, physicians and other health professionals do not make decisions in this way. Eddy (in Kahneman, Slovic, & Tversky, 1982, chap. 18) used Bayes formula to estimate the probability of a patient having cancer and illustrated how physicians make major errors in probabilistic reasoning. The author's evidence showed that physicians do not manage uncertainty very well. Although the use of systematic methods for managing uncertainty has been growing in medical school curricula, the application of these techniques has been sporadic.

The information-processing model of decision making attempts to provide an explanation of human thought by use of elementary processes, operations, or capabilities. This theory relies heavily on verbal reports to obtain information about the processes performed to solve a problem. Understanding and explanation take precedence over

prediction and control. Thinking aloud while performing a cognitive task is not frequently practiced so some training may be required before using this model (Elstein, Shulman, & Sprafka, 1978).

The regression model of judgment uses regression equations to relate a series of judgments to a set of predictor variables. This model is considered descriptive as it describes how people make decisions. The regression model, as well as the Bayesian model, distrust verbal testimony. Both models though have the advantage of providing methods for reducing human error and increasing the consistency and control of complex data management (Elstein, Shulman, & Sprafka, 1978).

From 1969-1973, a series of studies on medical problem solving were completed at Michigan State University (Elstein, Shulman, and Sprafka, 1978). The researchers sought to develop an information-processing model to describe medical diagnostic thinking. The findings were that diagnostic problems are solved through a process of hypothesis generation and verification. This is a psychological necessity due to the complexity of the clinical situation, the enormous amount of obtainable data, and the limited capacity of working memory.

Physicians were found to generate hypotheses early in a workup with only a limited data base. These hypotheses serve as organizing rubrics for working memory. Hypotheses may be revised or new ones generated as the workup continues. The

number of hypotheses considered at any one time rarely exceeds five. Cue acquisition, hypothesis generation, cue interpretation, and hypothesis evaluation were determined to be the major processes of a general model of medical inquiry. The data thus indicated that diagnostic problems were solved by a hypothetico-deductive method. It was also shown that medical students also used a process of hypothesis generation and verification.

Payton (1985), a physical therapist, undertook a study to analyze the problem solving of physical therapists and compare the results to the studies of Elstein, Shulman, and Sprafka (1978). Payton's study demonstrated that a sample of skilled physical therapy clinicians go through basically the same clinical reasoning process as skilled physicians. Like physicians, physical therapists intermingled the steps of information gathering, problem list formation, and treatment planning. All of the physicals therapists also began generating their problem lists within the first third of the interview.

Elstein (1994), in an update to the hypothetico-deductive strategy (Elstein, Shulman, & Sprafka, 1978), wrote of the criticisms since the mid-1980's of diagnostic reasoning being a complex and systematic generation and testing of hypotheses. It was argued that not all cases seen by an experienced physician required hypothetico-deductive reasoning. Patel and Groen (1986) argued that expert reasoning in non-problematic situations



looked more like pattern recognition or direct automatic retrieval from a well-structured network of stored knowledge. The researchers termed these simulations

Elstein (1994) in 1990 thus proposed a hybrid model of reasoning. The first part of the model stated that experts explicitly use the hypothesis-testing method whenever routine problem recognition methods fail. Elstein also expressed that if the rapid problem-classification of experts was broken down into its components, it would be found to consist of pattern recognition and hypothesis testing that is not explicitly verbalized. Apparently, experienced physicians use a hypothetico-deductive method of decision making only with difficult cases. There is an interaction between the clinician's level of skill and the perceived difficulty of the task. (Elstein, 1994; Sprafka (1978))

### Simulations

Simulations as evaluation tools have various advantages. They can be a standard by which performance can be judged and a way to get around the problems of using real patients in evaluations. Simulations also allow for the control of incidental variables. This control strengthens the validity of a test. The disadvantages of simulations are in the establishment of fidelity, validity, and reliability (Roberts, While, & Fitzpatrick, 1995).

High Fidelity Simulations. Elstein, Shulman, and Sprafka (1978) conducted a series of studies designed to evaluate how skilled physicians actually solve clinical

problems. Twenty-four physicians in internal medicine worked up and discussed with the researchers three simulated medical problems. The researchers termed these simulations high fidelity as actors were trained to play the roles of patients thus achieving high validity.

The patient evaluations were videotaped and immediately analyzed by the researchers along with the physician participant. As the videotape was reviewed, the physician was asked for a detailed analysis of each question, statement, and action during the workup. The primary conclusions were: (a) Skilled clinicians began forming hypotheses early in the evaluation, (b) The number of hypotheses rarely exceeded five, and (c) Competence may be related to experience with specific types of cases.

The research of Elstein, Shulman, and Sprafka (1978) has received criticism over the years. One of the earliest critics was McGaghie (1980). McGaghie stated that the researchers failed to prove the reliability and validity of the dependent variables (said to represent clinical competence) used in the high fidelity simulation studies. The author was also skeptical about the results of the data analyses. McGaghie even cast doubt on the psychological model that served as a foundation for the studies.

Standardized Patients. Standardized patients have been used to assess the clinical competence of medical students (Furman, Ross, Galofre, Heaney, & Mootz, 1994). Seven standardized patient cases were developed to evaluate 120

medical students in an ambulatory-care rotation. Simulated patients evaluated the students in the areas of history taking, physical examination, and communication skills. The simulated patient scores were analyzed for accuracy and reliability. Reliability and validity measures for these patient cases were found to be comparable to those of other institutions using standardized patients. The reliability and validity of standardized patients are not particularly strong and this evaluation method requires a great amount of effort and time.

Written Simulations. Patient management problems (PMPs) are written simulations of clinical encounters used in the testing programs of medical colleges, licensing, and certifying boards. A study by Page and Fielding (1980) studied the validity of these simulations. Evidence had not previously been provided to substantiate PMP performance with performance in the clinical setting.

Thirty community pharmacists were evaluated using a written patient management problem and an in-store assessment problem (ISAP) which replicated the written simulation in the clinical setting. Actors were trained to role play and evaluate the pharmacists in the ISAP. Correlation coefficients described a weak but positive relationship between the overall level of performance on the PMPs and ISAPs. It was found that the PMPs were good predictors of what the pharmacists did not do in practice but they were poor predictors of what they did do.

Roffman, Tobias, and Speedie (1980) examined the validity of written simulations as measures of problem solving capability in pharmacy students. The validity coefficients were not strong but the authors felt the validity of the written simulations was established.

A study conducted in nursing by Padrick (1990) compared three written simulations with three clinical situations to evaluate clinical decision making in hospice nurses. This research found that: (a) There was no difference between practice and simulation as to the initial approach of the nurse to the situation, and (b) There were significant differences between practice and simulation on the alternatives considered by the nurses, the reporting strategy, and the overall approach. It was concluded that findings from simulations may not be generalizable to practice.

Corcoran (1986) studied the factors of task complexity and nursing expertise in decision making. Six experts and five novices in hospice nursing were presented with three written cases representing three types of severe chronic pain and three levels of complexity for decision making. The study found the expert and novice nurses did not vary their initial approaches to planning but the experts did vary their overall approaches across cases of varying complexity. This supported previous research that had found the task itself is a major determinant of decision making behavior.

A new problem format for the written assessment of clinical decision-making skills is the key-feature problem.

A key feature is defined as a critical step in the resolution of a clinical problem, and a key-feature problem consists of a clinical case scenario followed by questions that focus on only those critical steps. (Page, Bordage, & Allen, 1995, p. 194)

This format is felt to effectively address the areas of content validity and test score reliability while accommodating the complexities required in clinical decision making.

Video Simulations. Elstein, Shulman, and Sprafka (1978) also produced films to simulate a patient encounter. In these films, the physician was heard but not seen. The camera remained on the patient to facilitate the viewer in adopting the role of physician. In this study, eight experienced physicians viewed 49 films. Response sheets and a process checklist completed by the physicians were used as two sources of data collection. The films were also stopped at selected points and the physician's impressions were tape recorded. This also occurred at the end of each film. In 96 percent of the cases, a problem formulation was generated no later than one minute into the interview.

Computer Simulations. The use of computerized clinical simulations is gaining momentum especially in the training aspect of health professionals. Reinecker (1985) described the designing of a clinical simulation problem used to credential respiratory therapists. Respiratory therapy

students can sit for this clinical simulation test after one year of work experience. The author stated two advantages of the clinical simulation patient management problem:

(a) Participants perceive the problem as relevant to the reality of clinical practice, and (b) Evaluation of clinical tasks can be standardized.

### Clinical Reasoning

Payton (1985) completed a descriptive study to analyze physical therapists' clinical problem solving and compare the results with those of the Elstein, Shulman, and Sprafka (1978) study. Ten skilled physical therapists were observed as they performed an initial interview with a real patient. The interviews were audiotaped and immediately after were reviewed by the researcher and the therapist. The review was guided by questions concerning the sequence of hypothesis formation and treatment planning. The study found that the physical therapists in the study solved clinical problems using the same clinical reasoning process described by Elstein, Shulman, and Sprafka.

A dissertation abstract by DuPont (1990) described a study to determine the effects of using the clinical reasoning process as an educational strategy for physical therapy students. Although the purpose was to evaluate the relationship between two personality dimensions of the students and successful use of clinical reasoning, the method of determining success in clinical reasoning was pertinent to this study.

Prior to and after instruction in the rules of the clinical reasoning process, seventy-five physical therapy students viewed a video of a pediatric patient evaluation. Following viewing, the students completed a cues rating list and a problem statement form to assess efficiency in rating diagnostic cues and accuracy in diagnosis. Prior to the study, ten expert pediatric physical therapists created two scoring keys for diagnostic efficiency and accuracy. The students did not improve in diagnostic efficiency but did improve in their ability to accurately diagnose a pediatric movement dysfunction.

#### Novice Versus Experienced Clinicians

May and Dennis (1991) surveyed 788 expert physical therapy clinicians in the United States and Australia to determine whether a particular cognitive style was prevalent among expert clinicians, to identify preferred sources of information for clinical decision making, and to determine the similarities and differences between American and Australian therapists. The physical therapy assessment and interviews with the patient were the preferred sources of information for decision making in both countries. Both groups had preferences for the receptive style of data gathering and the systematic style of information processing. A receptive style of data gathering was defined as being characterized by suspending judgment until all possible data have been collected, paying attention to detail, and attending to the implications of each piece of

data individually. Systematic information processing is a methodical approach, defining problems and constraints early, performing an ordered search for information, and completing one step before progressing to the next.

Jensen, Shepard, and Hack (1990) conducted a qualitative study to develop a conceptual framework and a data collection tool to begin an analysis of the work of the physical therapist. Eight therapists, representing three levels of experience, were observed in four different adult outpatient orthopedic settings. Data was collected through nonparticipant observation, recording of field notes, and audiotaping of treatment sessions. Five themes were developed to describe some aspect of the therapeutic intervention. These themes were:

1. Therapist allocation of treatment time,
2. The types and uses of information gathered from the patient,
3. Impact of the therapeutic environment on the therapeutic intervention,
4. Degree of responsive therapeutic interaction, and
5. Therapist integration of non-therapeutic interaction. (p. 318)

In the area of types and use of information gathered, it was found the experienced therapists sought out less information from the patient than did less experienced therapists. The experienced therapists built their questions on the patient's responses. The less experienced tended to be more perfunctory in their questions or focused more on mechanical procedures.



In a follow-up to this study, Jensen, Shepard, Gwyer, and Hack (1992), studied three master clinicians and three novice clinicians practicing in outpatient orthopedic physical therapy settings. The master clinicians were nominated and selected on the basis of their experience, expertise, and reputation in orthopedics. The novice clinicians had less than one year of experience. Data collection included observation of treatments, audiotaping of treatment sessions, interviews with clinicians and patients, and review of patient records. Five attribute dimensions were identified distinguishing the master clinician from the novice. The attribute dimensions were:

1. Ability to control the environment,
2. Evaluation and use of patient illness and disease data in a context-rich evaluation,
3. Focused verbal and nonverbal connection with the patient,
4. Equal importance of teaching to hands-on care, and
5. Confidence in predicting effective patient outcomes based on knowledge of pathology and experience with the course of healing. (p. 714)

The master clinicians demonstrated a much more elaborate cognitive framework than the novice clinicians. This framework was built on their more extensive knowledge base and their clinical experience with patients. The novice clinicians were much more rule-governed and followed their evaluation forms in hope of finding a diagnosis. The master clinicians were much more efficient and confident in their evaluation and treatment of patients. Similar to the May and Dennis study (1991), the master clinicians felt it necessary

to correlate subjective and objective data, weigh any evidence, and withhold judgment until the data had been corroborated. The novice clinicians demonstrated they were less selective of the data they gathered and more intent on gathering as much data as possible until the diagnosis emerged.

Palchik, Wolf, Cassidy, Ike, and Davis (1990) used written patient management problems to compare the information-gathering processes of medical students versus experienced clinicians. Agreement between the information-gathering processes occurred in five of the PMPs. The authors suggested that these cases required relatively straightforward information-gathering strategies. There was disagreement on the remaining nine PMPs. The experienced clinicians placed greater emphasis on the history-taking process whereas the students relied more on diagnostic studies. These findings followed the previous discussions on pattern recognition in less complex cases and the hypothetico-deductive model in more difficult cases.

Norman, Trott, Brooks, and Smith (1994) studied first-year residents in family medicine, first- and second-year residents in internal medicine, and experienced academic nephrologists through a series of eight complex written nephrology problems. Subjects were asked to solve the problem while thinking aloud. Analysis of variance showed a large gradient in diagnostic ability over the three groups. Increased experience was also related to increased

clustering of individual data and more extensive use of causal explanations. The author felt this study had important implications for student evaluation.

Although it is commonly accepted that curricula should be based on and students should be evaluated on common and treatable problems, it may be that difficulties experienced in demonstrating differences with expertise on various evaluation methods are a direct consequence of the use of common or relatively straightforward problems. However unrepresentative or unfair it may seem, the use of difficult problems may be the only way to see students really exercise their "clinical reasoning skills" or "problem-solving skills." (p. 119)

Embrey, Guthrie, White, and Dietz (1996) studied the clinical decision making processes of three experienced therapists and three inexperienced therapists as the therapists worked with 18 pediatric patients. The instrument was administered to all nursing students in one program's curriculum. The author reported that as students acquired more decision-making experience and skills, they would perceive themselves as making better decisions. The significant differences across the levels of nursing students were found except in characteristics of clinical decision making were identified through this study. These characteristics were:

1. Movement scripts provided insights into the clinical application of cognitive schemata based on previous experiences,
2. Procedural changes occurred rapidly during within session decision making,
3. Psychosocial sensitivity was important for positive interaction during therapy, and
4. Self-monitoring appeared to be pivotal in making clinical decisions as therapists self-assessed their practice. (p. 20)

Experienced clinicians had increased access to movement scripts resulting in self-monitoring being more positive and

intervention more effective. Experienced therapists had a high frequency of self-monitoring with rapid changes in intervention. The novice therapists reported a low frequency of positive self-monitoring and a lower frequency of procedural changes.

#### Clinical Decision Making in Nursing Scale

Jenkins (1985) developed the Clinical Decision Making in Nursing Scale (CDMNS) to measure perceptions of clinical decision making. Content validity was established through a pretest and critique, followed by an assessment by a panel of expert nurses. Reliability of the instrument was determined to be .83 using Cronbach's alpha. The instrument yields a total score and four subscale scores.

The scale was administered to 111 nursing students across three levels of one program's curriculum. The author expected that as students acquired more decision-making experiences and skills, they would perceive themselves as making better decisions. No significant differences across the three levels of nursing students were found except in Subscale A (Search for Alternatives or Options). A post hoc analysis determined that the differences were between the juniors and seniors.

In another study using the CDMNS, McFadden (1986) administered the scale to 153 senior nursing students to measure their perceptions of their clinical decision making and the relationship of these perceptions to learning style, personality type, age, sex, education, college career choice

and nursing work experience. No significant relationships were found. A Cronbach's alpha of .80 was reported for the reliability of the CDMNS.

Engberg (1987) investigated the relationship between CDMNS scores (reported behaviors) and accuracy in solving a videotaped simulation of a clinical problem (application of clinical decision making skills). Thirty-one registered nurses served as subjects. No significant relationship was found between the CDMNS scores and accuracy. A Cronbach's alpha of .93 was reported for the reliability of the CDMNS.

Seager (1990) administered the CDMNS to four levels of associate and baccalaureate degree nursing students. No significant difference in total scores was found between associate and baccalaureate degree students. Students in their first clinical course scored significantly higher total scores than students in their last clinical course. On Subscale A, students in their last clinical course scored significantly higher than students in their first clinical course. On Subscale B, students in their first clinical course scored significantly higher than those in their last clinical course. Baccalaureate degree students scored significantly higher on Subscale C than associate degree students. No significant differences were found on Subscale D.

In a dissertation by Day (1991), a model for clinical decision making, developed by the researcher, was evaluated with 244 postbaccalaureate students from six entry-level

master's degree physical therapy programs at the time of the students' graduation. One of the tools used to evaluate this model was the CDMNS. This study indicated no significant differences in performance on the clinical decision making scale among students from the six programs. The study also showed no significant relationships between CDMNS scores and either Graduate Record Examination scores or the students' grade point averages.

Thiele, Holloway, Murphy, Pendarvis, and Stucky (1991) studied the patterns and perceptions of 82 novice baccalaureate nursing students in clinical decision making. The students' perceptions of their clinical decision making behaviors were measured by the CDMNS. Students completed a clinical simulation to measure their clinical decision making patterns. Low scores on the CDMNS were verified by the responses given on the clinical simulation.

Corder (1992) examined the relationship between critical thinking (Watson-Glaser Critical Thinking Appraisal), clinical decision making (CDMNS), and several demographic factors in baccalaureate nursing students. Among the findings were that non-traditional students were older and scored higher on the CDMNS than the traditional aged group of students. Cronbach's alpha for reliability for the study was .84.

Weber (1992) used the CDMNS as a portion of a study designed to assess the effectiveness of gaming-simulation as a technique for teaching nursing diagnosis. The student

participants were 39 senior baccalaureate nursing students. The students involved in gaming-simulation scored significantly higher on Subscale D than students involved in a case study format.

In 1994, Cruickshank, Mackay, Matsuno, and Williams examined the relationship of the competence of 529 nurses in Western Australia to their career structure levels. One aspect of the study measured the nurses' clinical decision-making capabilities through completion of the CDMNS. The study showed the highly experienced nurses, with baccalaureate degrees, scored significantly higher on the CDMNS than nurses with hospital diplomas.

#### Other Studies

Arand and Harding (1987) used a standardized test of critical thinking skills, the Watson-Glaser Critical Thinking Appraisal (WGCTA), to assess problem solving at various points in a physical therapy curriculum. The subjects were 81 students in a baccalaureate physical therapy program. It was found that only one course, specifically geared to problem solving skills, was related to changes in scores on the standardized test. No significant relationship was found between grades and the level of problem solving skills.

In another study using the WGCTA, Scott and Markert (1994) administered the appraisal to 92 beginning medical students. The researchers found that critical thinking skills as measured by the WGCTA were moderately predictive

of academic success during the preclinical years of medical education. 1991.

Sloan, Donnelly, Drake, and Schwartz (1995) undertook a study of the sensitivity of subjective faculty evaluations. Forty-eight medical students were evaluated by four surgery faculty during a ten week clerkship. Each student was also evaluated through a number of objective measures. The students were then given an A, B, C, or E grade for both the subjective and objective evaluations.

On the subjective clinical faculty ratings, 23.0 percent of the students received A's and the rest received B's. On the objective measures, 12.5 percent of the students received A's, 73.0 percent B's, 12.5 percent C's, and 2.0 percent E's. None of the underachieving students (C's and E's on the objective measures) were identified as deficient by any of the clinical faculty. The authors concluded that subjective clinical evaluations should not be the sole measure of clinical ability.

#### Conclusions

The reviewed studies displayed a trend toward agreement on how health professionals go about making decisions. The aspect that continues to be a problem is how to assess the level of decision making of which someone is capable. Instrumentation was the primary threat to the internal validity of a number of these studies. The major problem in developing a study to measure clinical decision making



skills is the reliability and validity of the researcher's evaluation tool.

#### METHOD

Using this initial literature review as a foundation, the following chapter presents the methods used to conduct this study.

The purpose of this research was to assess the level of clinical decision making skills in physical therapy students at the University of Northern Iowa. This was a cross-sectional and longitudinal study using comparative and correlational data to test the hypothesis. The study used the Clinical Decision Making Scale (Denkin, 1984) to assess the clinical decision making skills of four levels of physical therapy students who graduated from the University of Northern Iowa. The study was conducted over a period of one year.

#### Sample Selection

The study used four levels of students from the University of Northern Iowa. The study was conducted at the University of Northern Iowa, Department of Health Sciences, Iowa City, Iowa. The study used four levels of students: the Class of 1993 graduated 40 students (12 males, 28 females), the Class of 1994 graduated 48 students (14 males, 26 females), the Class of 1995 graduated 44 students (13 males, 31 females), and the Class of 1996 graduated 44 students (17 males, 27 females). Three students from the Class of 1993 (1 male, 2 females) left the program after the initial testing.

For the cross-sectional aspect of this study, the Class of 1996 was used. The Class of 1996 had completed the first semester of the physical therapy program and had completed 12 weeks of clinical education. The study was conducted over a period of one year. The study was conducted over a period of one year.

## Chapter 3

### METHOD

#### Introduction

The purpose of this research was to assess the level of clinical decision making skills in physical therapy students across a curriculum. This was a cross-sectional and longitudinal study using comparative and correlational data to test the hypotheses. The study used the Clinical Decision Making Scale (Jenkins, 1985) to assess the clinical decision making skills of four levels of physical therapy students and graduates.

#### Sample Selection

This study used four levels of students from the Program in Physical Therapy at the University of Osteopathic Medicine and Health Sciences in Des Moines, Iowa. The Class of 1994 graduated 40 students (12 males, 28 females), the Class of 1995 graduated 40 students (14 males, 26 females), the Class of 1996 had 43 students (13 males, 30 females), and the Class of 1997 initially had 44 students (17 males, 27 females). Three students from the Class of 1997 (1 male, 2 females) left the program after the initial testing.

For the cross-sectional aspect of this study, the Class of 1994 was one year post-graduation. The Class of 1995 had just completed the entire 24 months of the physical therapy curriculum including 29 weeks of clinical internships. The Class of 1996 had completed 12 of the 24 months of the

curriculum including 9 weeks of clinical internships. Initial testing of the Class of 1997 took place at enrollment. Retesting the Class of 1997 to gather longitudinal data occurred following completion of one third of the curriculum (26 didactic weeks followed by 2 clinical weeks).

#### Data Collection

Testing of the students' clinical decision making skills was accomplished through the administration of the Clinical Decision Making Scale (CDMS) (Appendix B). The CDMS was published and copyrighted by Jenkins in 1983. This scale was mailed to the Class of 1994 during the second week of June 1995. The scale was administered to the Class of 1995 during graduation week (May 31, 1995) which was immediately preceded by the final 12 weeks of clinical internships. The Class of 1996 completed the scale on the first day of their second year of enrollment (June 19, 1995). Their first year ended with a seven week clinical internship. Administration of the scale to the Class of 1997 occurred during orientation to the program (June 6, 1995) and again on the first day of their third semester of enrollment (January 8, 1996).

The CDMS consisted of 40 items designed to measure the decision-making process. The 40 items were determined to be appropriate for assessing the clinical decision making of anyone in a health related area (Day, 1991). Scripted verbal instructions for completion of the scale were given to the

students at administration of the instrument by a physical therapy faculty member not associated with the research. Written instructions were mailed to the graduates participating in the study. The CDMS was untimed but usually requires approximately 20 minutes to complete.

The CDMS was designed to measure how nursing students perceived their clinical decision-making ability. Jenkins, after initial testing with the scale, revised the Likert-type scale choices so that the CDMS better reflected self-perceived decision-making behavior rather than perceived ability. The CDMS is divided into four subscales of the decision-making process based on Janis and Mann's (1977) criteria on decision making:

Subscale A: Search for Alternatives and Options  
(based on criterion 1)

Example of subscale item: If the clinical decision is vital and there is time, I conduct a thorough search for alternatives.

Subscale B: Canvassing of Objectives and Values  
(based on criterion 2)

Example of subscale item: I assist clients in exercising their rights to make decisions about their own care.

Subscale C: Evaluation and Reevaluation of Consequences (based on criteria 3, 6, and 7)

Example of subscale item: If a benefit is really great, I will favor it without looking at all the risks.

Subscale D: Search for Information and Unbiased Assimilation of New Information  
(based on criteria 4 and 5).

Example of subscale item: Looking for new information in making a decision is more trouble than it's worth. (Jenkins, 1985, p. 224)

Each subscale has ten items and the Likert-type response scale ranges from one to five. The range of possible scores

for each subscale is 10-50 with total scores for the CDMS ranging from 40-200. A higher score represents a higher quality of clinical decision making.

Scoring for the CDMS uses a weighting scale with 22 of the 40 items weighted as positive and 18 of the items weighted as negative. The researcher scored the instrument for each student and graduate using the scoring key provided by Jenkins. Each student and graduate received a total score and four subscale scores.

Jenkins established the content validity of the CDMS by designing the scale based on the decision making literature. The instrument was pretested and critiqued for congruity and clarity of scale items. Each item was then evaluated and rated by nurse education experts for content validity. Jenkins used a specification matrix and retained each item receiving a total matrix score of 70-77 percent agreement. At that time, the CDMS had an internal consistency reliability of .83 as determined by using Cronbach's alpha. (Jenkins, 1985). H. M. Jenkins (personal communication, March 4, 1995) reported to this researcher that an average reliability of .84 had been reported by 18 researchers using the CDMS.

H. M. Jenkins (personal communications, March 4 and 21, 1995) recommended research with groups outside nursing to refine items on the CDMS and to establish norms for these groups. Day (1991), in recommendations for further research, suggested administering the CDMS to different levels of

physical therapists to "further delineate the role of experience in clinical decision making and help establish baseline scores for different levels of therapists" (p. 67).

All students and graduates were also asked to complete a demographic data sheet indicating their gender and age (Appendix C). From grade records housed in the Program in Physical Therapy, the overall percentage grade average (range of 80-100 percent) was determined for those students in the Class of 1995 and Class of 1996. At the end of the immediately preceding clinical internships for the Classes of 1995 and 1996, the clinical instructor responsible for supervising each student was sent a letter and an author constructed questionnaire (Appendixes D and E). The clinical instructor was asked to rate the level of the student's clinical decision making skills on a Likert-type scale. The clinical instructors were also asked to provide their gender, age, and number of years they had been a physical therapist. A follow-up mailing was sent to non-responding graduates and clinical instructors in an attempt to improve the return rate. All data from these sources was recorded on a chart constructed by the researcher to aid in the organization of the data for each student.

Students, graduates, and clinical instructors received a letter explaining the study, issues of confidentiality, and the process of informed consent (Appendixes D and F). Completion and return of the CDMS and demographic data sheet by a student or graduate was understood as informed consent

as was completion and return of the questionnaire by a clinical instructor. Confidentiality of data was maintained by identifying each student on all data collection materials by a randomly selected number rather than by name. The code key connecting names to numbers was kept in a separate and secure location. No individual identification was used in the report of the data in this study.

### Data Analysis

Descriptive statistics were used to summarize the data, including the demographics, of the sample. The four groups were analyzed separately as well as in combination. The differences in clinical decision making between the four levels of physical therapy students, the first research question, were analyzed using an analysis of variance. Analyses of variance were computed for the total clinical decision making scale scores and the scores for each subscale. When significant differences were found, a post hoc analysis was completed to determine the source of the differences. An analysis of covariance was also computed to control for the possible effects of age.

The second research question was studied using longitudinal data from the Class of 1997. The data was analyzed using a dependent two-tailed t test for the total scores and an analysis of variance for the subscale scores.

The third and fourth research questions were evaluated through Pearson product-moment correlations. For the third research question, this quantified the relationships between

the students' overall level of clinical decision making and the students' overall percentage grade average. The relationship between the clinical instructors' rating of the students' clinical decision making skills and the students' total clinical decision making score was quantified to evaluate the fourth research questions. The fifth research question was evaluated using a two-tailed dependent t test to compare student total scores and clinical instructor ratings.

All of the data, including descriptive data, was analyzed using a statistical computer software program titled Statistica (Version 4.5). The .05 level of significance was accepted for all data analysis.



Chapter 4  
ANALYSIS OF THE DATA

Introduction

This cross-sectional and longitudinal study examined the clinical decision making skills of physical therapy students across a curriculum. Testing of the students' clinical decision making skills was accomplished through the administration of the Clinical Decision Making Scale. The relationship of these clinical decision making skills to students' grade point averages and clinical instructors' ratings of students was also examined. This chapter presents the analysis of the data collected in the study. Data collection was enhanced by high participation rates by both students and clinical instructors (Table 1).

Table 1

Participation Rates

Class	Students	Clinical Instructors
1994	35/40 = 87.5%	--
1995	40/40 = 100.0%	39/40 = 97.5%
1996	43/43 = 100.0%	43/43 = 100.0%
1997      Pre-Test	44/44 = 100.0%	--
Post-Test	41/41 = 100.0%	--

## Descriptive Data

The mean, standard deviation, and range were calculated for the age of the students, the age of the clinical instructors, and the years of experience of the clinical instructors (Table 2). Descriptive data was also calculated

Table 2

Demographic Data (all in years)

Variable	<u>n</u>	<u>Mean</u>	<u>Median</u>	<u>SD</u>	Range
Classes					
1994 Age	35	27.45	27.00	2.74	24.00-34.00
1995 Age	40	27.12	26.00	3.58	24.00-39.00
1996 Age	43	26.02	24.00	5.32	22.00-50.00
1997 Age	44	24.02	23.00	2.74	21.00-38.00
Combined	162	26.06	25.0	3.99	21-50
Clinical Instructors (Male = 28, Females = 54)					
Age	82	35.65	32.5	8.60	24-59
Experience	82	9.90	6.0	9.20	1-37

for the total clinical decision making scale scores (Table 3), each of the four clinical decision subscale scores (Table 3), the grade point averages (Table 4), and the clinical instructor rating scale (Table 4). This latter descriptive data was used to determine whether the variables

Table 3

Descriptive Statistics - CDMS Total and Subscale Scores

<u>Variable</u>	<u>n</u>	<u>Mean</u>	<u>Median</u>	<u>SD</u>	<u>Range</u>
Total CDMS Scores					
Class of 1994	35	146.69	146.00	11.39	119.00-183.00
Class of 1995	40	150.08	150.00	8.81	131.00-170.00
Class of 1996	43	150.63	150.00	8.75	134.00-172.00
Class of 1997/pre	44	148.75	147.50	10.05	131.00-168.00
Combined classes	162	149.13	--	9.76	119.00-183.00
Class of 1997/post	41	151.22	152.00	8.32	135.00-167.00
CDMS Subscale A					
Class of 1994	35	38.46	38.00	2.91	34.00-48.00
Class of 1995	40	38.92	39.00	2.49	34.00-46.00
Class of 1996	43	38.44	39.00	2.74	30.00-45.00
Class of 1997/pre	44	37.23	37.00	2.29	32.00-43.00
Combined classes	162	38.23	--	2.66	30.00-48.00
Class of 1997/post	41	37.76	38.00	2.16	33.00-42.00
CDMS Subscale B					
Class of 1994	35	36.17	36.00	4.55	26.00-48.00
Class of 1995	40	36.75	37.00	2.61	31.00-44.00
Class of 1996	43	37.67	38.00	2.81	32.00-46.00
Class of 1997/pre	44	37.45	37.00	3.62	29.00-45.00
Combined classes	162	37.06	--	3.45	26.00-48.00
Class of 1997/post	41	38.24	39.00	2.93	31.00-43.00
CDMS Subscale C					
Class of 1994	35	36.57	36.00	3.88	27.00-46.00
Class of 1995	40	37.88	37.50	4.06	29.00-44.00
Class of 1996	43	36.70	37.00	3.50	28.00-45.00
Class of 1997/pre	44	37.91	38.00	4.38	26.00-46.00
Combined classes	162	37.29	--	3.98	26.00-46.00
Class of 1997/post	41	37.66	37.00	4.02	31.00-46.00
CDMS Subscale D					
Class of 1994	35	35.48	35.00	2.79	32.00-42.00
Class of 1995	40	36.52	37.00	2.73	31.00-42.00
Class of 1996	43	37.81	37.00	2.93	33.00-45.00
Class of 1997/pre	44	36.18	36.00	3.04	28.00-41.00
Combined classes	162	36.55	--	2.98	28.00-45.00
Class of 1997/post	41	37.56	38.00	2.02	33.00-43.00

Table 4

Descriptive Statistics - Grade Point Averages and Clinical  
Instructor Ratings

Variable	<u>n</u>	<u>Mean</u>	<u>Median</u>	<u>SD</u>	Range
Grade Point Average					
Class of 1995	40	89.67	90.12	2.98	84.03-95.16
Class of 1996	43	89.13	89.66	2.96	80.46-94.10
Combined	83	89.39	--	2.96	80.46-95.16
Clinical Instructor Ratings					
Class of 1995	39	4.16	4.0	0.57	2.85-5.00
Class of 1996	43	4.07	4.0	0.56	2.00-5.00
Combined classes	82	4.11	--	0.56	2.00-5.00

were normally distributed. This was accomplished through Tabachnick and Fidell's (1983) formula for determining whether the value of skewness for each variable differed significantly from zero. Three variables were shown to not be normally distributed. These variables were the Subscale A scores for the Class of 1994, the grade point averages for the Class of 1996, and the extrapolated clinical instructor ratings (Appendix G).

A Cronbach's alpha was determined to assess the internal consistency between the subscale scores of the Clinical Decision Making Scale. The coefficient alpha for the Classes of 1994-1997 subscale scores was .79. The coefficient alpha for the Class of 1997 post-test subscale

scores was also .79. When assessing the consistency between the Class of 1997 pre-test and post-test subscale scores, the coefficient alpha was determined to be .84.

#### Research Question One

The first research question was: Are there differences in clinical decision making skills between physical therapists who are one year post-graduation, physical therapy students who have just completed a curriculum, physical therapy students who have completed one year of a curriculum, and physical therapy students that are just beginning a curriculum? A one-way analysis of variance was used to analyze the difference between the total scores of the four levels of students. The samples were normally distributed (Appendix G), an  $F_{\max}$  showed there to be homogeneity of variance of the distributions (Appendix H), and although the sampling was not random the samples were independent of each other. Thus, the assumptions were met for using a one-way analysis of variance.

The results of this analysis of variance were  $F(3,158) = 1.22$ ,  $p = .304$ . The  $F$  ratio of 1.22 was lower than the critical value of 2.66 at the .05 level of significance. This  $F$  ratio was not significant and the analysis failed to reject the null hypothesis.

An analysis of covariance was used on the same data to determine if age was a factor in the scores. The results of

the analysis of covariance were  $F(3,157) = 1.20$ ,  $p = .31$ . The  $F$  ratio of 1.20 was lower than the critical value of 2.66 at the .05 level of significance. This  $F$  ratio was also not significant.

A multivariate analysis of variance was used to determine if there were differences on the subscale scores between the four levels of students (Table 5)

Table 5

Multivariate Analysis of Variance of CDMS Subscale Scores

Source	<u>df</u>	<u>F</u>	<u>p</u>	<u>Mean Square Error</u>
Subscale A	3,158	3.30*	.022	6.80
Subscale B	3,158	1.54	.206	11.80
Subscale C	3,158	1.35	.261	15.77
Subscale D	3,158	4.59*	.004	8.30

\* $p < .05$

Tukey's HSD Procedure

Variable	Class Differences	<u>p</u> *
Subscale A	1995 and 1997	.015
Subscale B	No differences	--
Subscale C	No differences	--
Subscale D	1994 and 1996	.002
	1996 and 1997	.041

\* $p < .05$

The analysis revealed significant  $F$  ratios for Subscale A and Subscale D. Tukey's HSD procedure revealed significant differences on Subscale A between the Classes of 1995 and 1997. The analysis also revealed significant differences on Subscale D between the Classes of 1994 and 1996, and the Classes of 1996 and 1997.

An analysis of covariance was used to control for the effect of participant age on the subscale scores. As shown in the results in Table 6, the analysis of covariance and

Table 6

Multivariate Analysis of Covariance of CDMS Subscale Scores

Source	<u>df</u>	<u>F</u>	<u>p</u>	<u>Mean Square Error</u>
Subscale A	3,157	4.48*	.005	6.66
Subscale B	3,157	2.17	.094	11.65
Subscale C	3,157	1.18	.318	15.82
Subscale D	3,157	4.60*	.004	8.35

\* $p < .05$

Tukey's HSD Procedure

Variable	Class Differences	$p^*$
Subscale A	1995 and 1997	.014
Subscale B	No differences	--
Subscale C	No differences	--
Subscale D	1994 and 1996	.002
	1996 and 1997	.042

\* $p = < .05$

the resultant post-hoc procedure gave the same results as the multivariate analysis of variance.

#### Research Question Two

The second research question was: Is there a difference in clinical decision making skills of physical therapy students between enrollment and completion of one-third of the curriculum? This question was tested using a two-tailed t test for dependent samples on the pre- and post-test scores for the Class of 1997. The samples were normally distributed (Appendix G), an  $F_{\max}$  showed there to be homogeneity of variance of the distributions (Appendix H), and there was independence of the samples. Thus, the assumptions were met for using a dependent t test.

The results of the t test were  $t(40) = -2.01$ ,  $p = .051$ . The t value of  $-2.01$  was higher than the critical value of  $-2.021$  at the .05 level of significance. This t value was not significant and the analysis failed to reject the null hypothesis.

An effect size was calculated for this data to determine the practical significance of these results. The effect size was .34. This denoted that 63.31 percent of the total scores on the CDMS pre-test were less than or equal to the mean of the scores on the post-test. Since an effect size of 50 percent would be expected if the means were equal, this was an effect of only 13.31 percent. An effect



size of less than .50 does not denote much practical significance.

A multivariate analysis of variance was used to determine the differences between the pre- and post-test subscale scores for the Class of 1997 (Table 7).

Table 7

Multivariate Analysis of Variance of Class of 1997

Longitudinal Data

Source	<u>df</u>	<u>F</u>	<u>p</u>	<u>Mean Square Error</u>
Pre-Test	1,83	1.48	.227	21.47
Post-Test	3,249	2.68*	.047	6.30
Interaction	3,249	1.54	.205	6.30

\* $p < .05$

Tukey's HSD Procedure

Variable	Subtest Difference	<u>p</u> *
Pre-Subscale C	Pre-Subscale D	.027
Pre-Subscale D	Post-Subscale B	.004

\* $p = < .05$

The results were  $F(3,249) = 2.68$ ,  $p = .047$ . The  $F$  ratio of 2.68 was higher than the critical value of 2.60 at the .05 level of significance. To determine the source of this

significant difference, a Tukey's HSD procedure was performed. This analysis showed there to be significant differences between the pre-subscale C scores and pre-subscale D scores, and the pre-subscale D scores and the post-subscale B scores. No significant differences were achieved between like scales on the pre- and post-tests.

#### Research Question Three

The third research question was: Is there a relationship between the student's level of clinical decision making and the student's overall percentage grade average in the academic curriculum? A Pearson product-moment correlation was used to analyze the data. The assumptions of paired scores and a rectilinear relationship between the variables were met for this data analysis.

For the Class of 1995, the results of the Pearson product-moment correlation were  $r = -.14$ ,  $t(40) = -0.889$ ,  $p = .38$ . This negative correlation indicated that as one variable increased the other decreased. The  $t$  value of  $-0.889$  was greater than the critical value of  $-2.021$  at the .05 level of significance. The correlation coefficient was not significant and there was insufficient evidence to reject the null hypothesis. The coefficient of determination for this correlation was .02. This indicated that two percent of the variance in grade point average was

associated with the variance in the total clinical decision making score.

For the Class of 1996, the results of the Pearson product-moment correlation were  $r = -.019$ ,  $t(43) = -0.12$ ,  $p = .905$ . This negative correlation indicated that as one variable increased the other decreased. The  $t$  value of  $-0.12$  was greater than the critical value of  $-2.018$  at the .05 level of significance. The correlation coefficient was not significant and there was insufficient evidence to reject the null hypothesis. The coefficient of determination for this correlation was .0004. This indicated that 0.04 percent of the variance in grade point average was associated with the variance in the total clinical decision making score.

Correlation studies are stronger with a sample size of more than 50 and are even more reliable with a sample size of 75 to 100. The data on the total scores for the Clinical Decision Making Scale and the grade point averages were combined for the Classes of 1995 and 1996 (sample size of 83) and a third correlation analysis was completed. The results of this analysis were  $r = -.081$ ,  $t(83) = -0.734$ ,  $p = .465$ . This negative correlation again indicated that as one variable increased the other decreased. The  $t$  value of  $-0.734$  was greater than the critical value of  $-1.99$  at the .05 level of significance. The correlation coefficient was

not significant and there was insufficient evidence to reject the null hypothesis. The coefficient of determination for this correlation was .007. This indicated that 0.07 percent of the variance in grade point average was associated with the variance in the total clinical decision making score.

#### Research Question Four

Research question four was: Is there a relationship between a clinical instructor's rating of a student's clinical decision making skills and the student's performance on a tool designed to measure this skill? A Pearson product-moment correlation was used to analyze the data. The assumptions of paired scores and a rectilinear relationship between the variables were met for this data analysis.

For the Class of 1995, the result of the Pearson product-moment correlation was  $r = -.007$ ,  $t(39) = -0.043$ ,  $p = .96$ . This negative correlation indicated that as one variable increased the other decreased. The  $t$  value of  $-0.043$  was greater than the critical value of  $-2.023$  at the .05 level of significance. The correlation coefficient was not significant and there was insufficient evidence to reject the null hypothesis. The coefficient of determination for this correlation was .00005. This indicated that 0.005 percent of the variance in clinical instructors' ratings was

associated with the variance in the total clinical decision making scores.

For the Class of 1996, the results of the Pearson product-moment correlation were  $r = .066$ ,  $t(43) = 0.42$ ,  $p = .674$ . This positive correlation indicated that as one variable increased the other increased. The  $t$  value of 0.42 was less than the critical value of 2.018 at the .05 level of significance. The correlation coefficient was not significant and there was insufficient evidence to reject the null hypothesis. The coefficient of determination for this correlation was .004. This indicated that 0.40 percent of the variance in the clinical instructors' ratings was associated with the variance in the total clinical decision making score.

To increase the strength of the correlation analysis, the data on the total scores for the Clinical Decision Making Scale and the clinical instructors' ratings were combined for the Classes of 1995 and 1996 (sample size of 83). The results of this third analysis were  $r = .027$ ,  $t(82) = 0.249$ ,  $p = .804$ . This positive correlation indicated that as one variable increased the other increased. The  $t$  value of 0.249 was less than the critical value of 1.99 at the .05 level of significance. The correlation coefficient was not significant and there was insufficient evidence to reject the null hypothesis. The coefficient of determination

for this correlation was .0008. This indicated that 0.08 percent of the variance in grade point average was associated with the variance in the total clinical decision making score.

#### Research Question Five

The last research question was: Is there a difference between student and clinical instructor ratings of the students' clinical decision making skills? The clinical instructors' ratings were extrapolated by multiplying x 40 to match the scale of the students' total scores (Table 8).

Table 8

#### Descriptive Statistics - Classes of 1995 and 1996 CDMS Total Scores and Extrapolated Clinical Instructor Scores

Variable	<u>n</u>	<u>Mean</u>	<u>Median</u>	<u>SD</u>	Range
Student CDMS Total Scores	83	150.36	150.00	8.73	131.00 - 172.00
Extrapolated CI Scores	82	164.57	160.00	22.59	80.00 - 200.00

The student scores were normally distributed while the clinical instructor ratings were not normally distributed (Appendix G). Although an  $F_{\max}$  also showed a violation of the homogeneity of variance assumption (Appendix H), there was independence of the samples. The assumptions for using a

dependent  $t$  test were not completely met. Thus, a nonparametric test, the Wilcoxon matched-pairs signed-rank test, was used to analyze the data. The results of this analysis are shown in Table 9.

Table 9

Wilcoxon Matched-Pairs Signed-Rank Test of CDMS Total Scores and Extrapolated Clinical Instructor Ratings

Ranks	<u>n</u>	$\Sigma$ Rank	<u>z</u>	<u>p</u> *
+	16	528	-5.24	.0001
-	64	2712		

\* $p < .05$  Note: 2 cases eliminated for difference = 0.

The  $z$  value of -5.24 was highly significant ( $p = .0001$ ) and supported the rejection of the null hypothesis.

An effect size was calculated for this data to determine the practical significance of these results. The effect size was .77. This denoted that 72.06 percent of the students' scores on the CDMS were less than or equal to the mean of the extrapolated clinical instructor ratings. Since an effect size of 50 percent would be expected if the means were equal, this was an effect of 22.06 percent.

### Summary

In summary, the analysis of the data in this study did not support the rejection of the null hypothesis for the total scores in Research Question One but did support the rejection of the null hypothesis for the Subscale A and D scores. The rejection of the null hypotheses for Research Questions Two, Three, and Four was not supported by this analysis. The data did support the rejection of the null hypothesis for Research Question Five. The next chapter will summarize and discuss the findings of this study.



## Chapter 5

### SUMMARY, DISCUSSION, CONCLUSIONS, AND RECOMMENDATIONS

#### Introduction

The purpose of this research was to assess the level of clinical decision making skills in physical therapy students across a curriculum. This study used four levels of students from the Program in Physical Therapy at the University of Osteopathic Medicine and Health Sciences in Des Moines, Iowa. A total of 162 students participated in the study (Class of 1994/35 students, Class of 1995/40 students, Class of 1996/43 students, Class of 1997/44 students).

For the cross-sectional aspect of this study, the Class of 1994 was one year post-graduation. The Class of 1995 had just completed the entire 24 months of the physical therapy curriculum including 29 weeks of clinical internships. The Class of 1996 had completed 12 of the 24 months of the curriculum including 9 weeks of clinical internships. Initial testing of the Class of 1997 took place at enrollment. Retesting the Class of 1997 to gather longitudinal data occurred following completion of one third of the curriculum (26 didactic weeks followed by 2 clinical weeks).

Testing of the students' clinical decision making skills was accomplished through the administration of the

Clinical Decision Making Scale (CDMS) (Jenkins, 1985). The CDMS consisted of 40 items designed to measure the decision-making process. The 40 items were determined to be appropriate for assessing the clinical decision making of anyone in a health related area (Day, 1991).

Jenkins established the content validity of the CDMS by designing the scale based on the decision making literature. The instrument was pretested and critiqued for congruity and clarity of scale items. Each item was then evaluated and rated by nurse education experts for content validity. Jenkins used a specification matrix and retained each item receiving a total matrix score of 70-77 percent agreement. The CDMNS had an internal consistency reliability of .83 as determined by using Cronbach's alpha.

#### Summary of the Findings

The findings of this study are presented in the following summary of the research questions. The primary research question for this study was: Are there differences in clinical decision making skills between physical therapists who are one year post-graduation, physical therapy students who have just completed the curriculum, physical therapy students who have completed one year of the curriculum, and physical therapy students that are just beginning the curriculum? In this cross-sectional aspect of the study, no significant differences were found between the

total scores on the Clinical Decision Making Scale for the Classes of 1994, 1995, 1996, and 1997.

Subscale scores did show significant differences. The Class of 1995 scored significantly higher on Subscale A (Searching for Alternatives and Options) than the Class of 1997. On Subscale D (Searching for Information and Unbiased Assimilation of New Information), the Class of 1996 scored significantly higher than both the Class of 1994 and the Class of 1997. The same results were achieved when age was used as a covariate.

The second research question investigated in this study was: Is there a difference in clinical decision making skills of physical therapy students between enrollment and completion of one third of the curriculum? This longitudinal component of the research displayed statistical results closely approaching significance ( $p = .051$ ). Analysis for practical significance lent minimal strength to these results as there was only an effect of 13.31 percent.

The Class of 1997 scored higher on the CDMS post-test than on the pre-test in three out of the four subscales (A, B, and D). The average post-test Subscale C score was slightly lower than the pre-test average score. None of the subscale differences were significant.

The third research question was: Is there a relationship between the student's level of clinical

decision making and the student's overall percentage grade average in the academic curriculum? No significant relationship was found in this study. Therefore, it was not possible to predict the students' clinical decision making skills from grade point averages.

The fourth research question was: Is there a relationship between a clinical instructor's rating of a student's clinical decision making skills and the student's performance on a tool designed to measure this skill? This study showed no significant relationship between the students' total scores on the CDMS and the clinical instructors' ratings. Therefore, it was not possible to predict the students' clinical decision making skills from the clinical instructors' ratings of the students.

The last research question was: Is there a difference between student and clinical instructor ratings of the students' clinical decision making skills? The results of this research indicated a significant difference between student and clinical instructor ratings.

The extrapolated clinical instructor ratings were shown to be significantly higher than the Class of 1995 and 1996 total CDMS scores. These results should be analyzed with care as the assumptions for using a dependent t test were not met and a nonparametric test with less power, the Wilcoxon matched-pairs signed-rank test, was used to analyze

the data. The primary problem with this analysis was the extrapolation of scores from the Likert-type scale completed by the clinical instructors. Extrapolating from a scale of five to a scale of 200 may have caused the distribution to be distorted. Rather than extrapolating the clinical instructor ratings, it would have been appropriate to have the students rate themselves on the same five point scale. This would have decreased the chance of violating the assumptions of normal distribution and homogeneity of variance.

#### Discussion of the Findings

The purpose of this study was to assess the level of clinical decision making skills of physical therapy students across a curriculum. This was in response to the need for assessment of curricular outcomes and the problem of finding a means to assess these clinical decision making behaviors. Jenkins' (1985) Clinical Decision Making Scale was used for this study.

There are a number of comparisons that can be drawn between this study and the research cited in the review of literature. Jenkins (1985) administered the CDMS to 111 students across three levels of a nursing program. Jenkins' study did not find significant differences between the total CDMS scores but did find that senior nursing students scored significantly higher on subscale A than junior nursing

students. Seager (1990) also found that nursing students in their last clinical course scored higher on Subscale A than students in their first clinical course.

This study's results, using a sample of physical therapy students, were consistent with the results of these two studies suggesting applicability of this instrument to populations outside of nursing. Although there were no significant differences between the total scores of the four levels of students, the Class of 1995 scored significantly higher than the Class of 1997 in the area of searching for alternatives and options (Subscale A). This was an expected finding as students at the end of the curriculum have experienced a wider range of alternative evaluations and treatments from which they can choose. Students at the very beginning of the curriculum have not yet had exposure to the curricular content and all of the variations available to them.

In this study, The Class of 1996 also scored significantly higher than both the Class of 1994 and the Class of 1997 in searching for information and unbiased assimilation of new information (Subscale D). Again, the lower scores by students just beginning a program (Class of 1997) were expected due to the fact the students did not yet know the many alternatives open to them and how to go about researching these alternatives. The significantly lower

scores by the Class of 1994 were not expected by the researcher. There could be several reasons for this significant difference.

The Class of 1996 had just finished the first year of the curriculum including the first seven week full-time internship. These students had substantial practice in researching the treatment alternatives open to them during this internship. Also, at this point in the curriculum, students are very open to new information and seek out judgments from the faculty and their clinical instructors.

Students one year post-graduation may have scored lower on Subscale D as they may have been refining the skills learned in the curriculum rather than aggressively searching out further alternatives. Relatively new graduates may not seek out advice from others for fear of appearing incompetent to their peers and supervisor. Also, the graduates may not recognize the thinking processes they actually go through each time they make a clinical decision as these processes may have become more innate.

The results obtained in the cross-sectional research may have been impacted by the tendency for continual changes in faculty, teaching methods, and curricular content of the physical therapy program. Over the past two years, the Program in Physical Therapy at the University of Osteopathic Medicine and Health Sciences has experienced several changes

in faculty and teaching methods. The faculty as a whole have also placed a greater emphasis on clinical decision making in courses across the curriculum. These changes may account for the lack of an increasing progression of total and subscale scores from the novice student to the graduate with a year of experience. Also, the results of these faculty and curricular changes may have been best reflected in the Class of 1996 total and subscale scores.

Normative data for the CDMS is not available for any population of health care professionals. It is thus difficult to relate the results of this study to any national data. The results are similar to Day's (1991) study of 244 physical therapy students, in six different programs, at the time of graduation. Day's sample had a total score mean of 151.0 with a standard deviation of 9.26. In this study, the Class of 1995 at the time of graduation had a similar total score mean of 150.08 with a standard deviation of 8.81. The total score means from the seven programs (six from Day's research and one from this study) ranged from 149.00-153.00.

The results of the analysis of the total and subscale scores was the same when accounting for the age of the students. Jenkins (1985) and McFadden (1986) also found age to have no effect on or relationship with CDMS scores. Corder (1992) found that older non-traditional students



scored higher on the CDMS than the traditional aged group of students. The results of this study were probably due to the homogeneous nature of the sample. Although the age range of the students was 21-50 years of age, the mean was 26 years with a median of 25 years and a standard deviation of 3.99.

The longitudinal component of this study provided the most useful data to the researcher. The Class of 1997 exhibited a near significant increase (from 148.75 to 151.22) in their total CDMS scores between enrollment and the time of the second testing. The post-test was administered after the second block of the curriculum which ended with two weeks of clinical experience.

The first two blocks of the curriculum lay the foundation for the rest of the curriculum. Decision making skills are introduced during the second block of the curriculum but are further developed and refined in Blocks III, IV, V, and VI. The results of this study support longitudinal testing of students after each block of the curriculum. This may yield a better indication than cross-sectional testing of when and to what degree decision making skills are developed throughout the curriculum.

Day (1991) found no relationship between CDMS scores and grade point averages of the 244 physical therapy students. Arand and Harding (1987) found no relationship between grades and problem solving skills in physical

therapy students. This study also found there to be no relationship between the CDMS total scores and grade point averages.

Grade point averages are quantitative measures of knowledge gained in the curriculum but do not factor in the knowledge gained on clinical internships (which are graded pass/fail). Faculty rely on the students' clinical experiences to further develop and refine clinical decision making skills. Thus, the grade point average is not an accurate predictor of the level of students' clinical decision making skills.

The results of this study also call to question the ability of clinical instructors to rate students on clinical decision making skills. It is difficult for a clinical instructor to ascertain a student's level of clinical decision making skills through observation. Unless a clinical instructor has a student verbalize their thought processes, it may be difficult for a clinical instructor to accurately rate the student's skill level. The clinical instructor may also have more confidence than the student in the student's skills.

A number of clinical instructors rated students at the top level of 5 on the Likert-type scale. This denoted that the student always used the clinical decision making process as in the definition provided to the clinical instructors.

Ratings of 5 were given to a number of the students that had only completed one year of the curriculum. It is not possible though to discern if the clinical instructor ratings were more accurate or if the students' scores on the CDMS were more accurate. The substantial difference on the ratings could be attributed to overconfidence on the part of the clinical instructors or underconfidence of the students.

Sloan, Donnelly, Drake, and Schwartz (1995) found that subjective clinical faculty ratings of medical students were higher than objective measures of knowledge. This study found that clinical instructor ratings of physical therapy students' clinical decision making skills were significantly higher than students' scores on the CDMS.

This study can only make inferences to the Program in Physical Therapy at the University of Osteopathic Medicine and Health Sciences. Any generalizations to other programs must be made with extreme care. Maturation could have been a threat to the internal validity of the longitudinal portion of this study. The students decision making skills may have improved due to personal growth occurring over the first two semesters of a graduate program.

Caution may be warranted in recommending this instrument to assess clinical decision making skills. Although several studies provided evidence of good reliability of the CDMS, research using the CDMS has

produced minimal significant results. It may be the CDMS is not sensitive to subtle changes in skill level. The items in the CDMS also may not be valid measures of clinical decision making. The content validity of the CDMS warrants further exploration.

Physical therapy students may also have a fairly high level of decision making abilities prior to enrolling in the program. This could be a result of the highly competitive nature of admissions and an emphasis on these abilities during the interview process. Many of these students have extensive experience in physical therapy clinics prior to admission into the curriculum. This may give those students the opportunity to observe therapists in the decision making process. The physical therapy program curriculum may only be refining students' already established decision making skills and facilitating the students' application of these skills to clinical situations.

#### Conclusions

As a result of this study, the researcher made the following conclusions:

1. Physical therapy students at different levels of the curriculum did not exhibit differences in overall clinical decision making skills.

2. Physical therapy students at different levels of the curriculum did exhibit differences in specific subsets of clinical decision making skills.

3. Physical therapy students exhibited growth in clinical decision making skills across the first year of the curriculum.

4. Physical therapy students' clinical decision making skills could not be predicted from either grade point averages or from the clinical instructors' perceptions of the students' clinical decision making skills.

#### Recommendations

This study was the beginning step in a process to determine appropriate outcome assessment measures for clinical decision making abilities in a physical therapy curriculum. The data contributes to a limited body of knowledge on outcome assessment in physical therapy education. This research will be extended with the Class of 1997 to track their clinical decision making abilities over the rest of the physical therapy program.

The Clinical Decision Making Scale may not have detected any significant differences in total scores but it did detect significant differences in two of the four subscales. If this instrument is to be used as an outcome assessment tool, the subscales may be more valuable and sensitive sources of information than the scale as a whole.

Other means of determining students' clinical decision making skills may not be valid methods as shown in this and other studies. Grade point average has been shown to not be predictive of decision making skills. Also called to question is the ability of clinical instructors to rate students on clinical decision making skills. Further study needs to be done in this area with an instrument that will give comparable scores from both students and clinical instructors.

Future research with the Clinical Decision Making Scale could be designed in several ways. A longitudinal study of physical therapy students/graduates (with testing occurring at enrollment, graduation, and one, three, five, and ten years post-graduation) would give a picture of physical therapists' development over their education and career.

In an effort to establish normative data, physical therapy programs across the country could be enlisted to administer the CDMS to students at graduation. Comparisons in scores could also be made between bachelor, master, and doctoral programs that are preparing the student for entrance into the physical therapy profession.

Another recommendation for future research is the development of a measurement instrument specific to clinical decision making skills in physical therapy. This would be an

ambitious task but one that would be valuable to physical therapy education.

If physical therapy educational programs are going to rely on clinical instructors to evaluate students on their skills, the program must be assured that the clinical instructors are accurate in their evaluations. Although the instrumentation in this study could have been improved, the data lends strength to the need for further study.

A better instrument could be developed to compare the students' and clinical instructors' perceptions of the students' abilities. Training programs for clinical instructors could be developed with analysis of the clinical instructors' rating abilities prior to and after training. The CDMS, or another instrument, could also be administered to clinical instructors to determine their levels of clinical decision making abilities. This would show whether the clinical instructors responsible for the education of physical therapy students have an appropriate level of clinical decision making skills.

Physical therapists will continue to be challenged by the rapid changes taking place in health care. Physical therapists are currently entry points into the health care system and may soon become primary care providers for some patients. It is imperative the faculty of physical therapist educational programs are assured they are preparing

graduates who have developed the appropriate clinical decision making skills. Further research needs to be completed to develop a means to guarantee that each physical therapy graduate is indeed meeting the profession's expectations.



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## APPENDIX

## Appendix A

## PERMISSION LETTERS FROM CDMNS AUTHOR

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# George Mason University

College of Nursing and Health Science  
Fairfax, Virginia 22030-4444

(703) 993-1900/1901  
Fax: (703) 993-1942

Please reply to:  
5504 Akridge Court  
Fairfax, VA 22032

Dear Colleague:

Thank you for your interest in the Clinical Decision Making in Nursing Scale (CDMNS).

For information on reliability and validity data for the original version of the CDMNS, see "A Research Tool for Measuring Perceptions of Clinical Decision Making" in the July/August 1985, Vol 1, No 4 issue of the Journal of Professional Nursing. The scoring system anchors for the scale have been changed from agree/disagree to percentages in order to reflect process rather than perception. However, this should not hamper its use.

The CDMNS is covered by copyright and is available for research or evaluation of clinical practice. My policy is to grant permission to reproduce and use the scale if I:

- 1) am assured of receiving results of the study,
- 2) receive a copy of the reliability and validity estimates obtained,
- 3) am credited with authorship in any use, associated report, or publication of the instrument, and
- 4) am permitted to use your name and address as a reference source.

Sincerely,



Helen M. Jenkins, PhD, RN  
Associate Professor  
College of Nursing and Health Science

---

# George Mason University

College of Nursing and Health Science  
Fairfax, Virginia 22030-4444

(703) 993-1900/1901  
Fax: (703) 993-1942

5504 Akridge Court  
Fairfax, VA 22032  
March 21, 1995

M. Susan Cigelman, Ed.S., P.T.  
4609 77th Street  
Des Moines, IA 50322

Dear Susan:

Thank you for your letter of March 4, 1995 requesting information about the Clinical Decision Making in Nursing Scale (CDMNS). I give permission for you to use the CDMNS, with the abbreviated title, in your project if you so desire. I am including with this letter an abstract and a copy of the scale along with the letter I send to persons requesting its use. Please note the conditions of use in the last paragraph.

If you decide that the CDMNS is appropriate for your use and when you plan on using it, please let me know so that I can send the directions for scoring. I hope that you will be able to provide some conclusions from the data you collect because I am interested in not only refining the items, but also in establishing norms for various groups. Information on group scores, and item and factor analyses would be particularly helpful.

Please let me know how things are going from time to time. Good luck in your research. I look forward to hearing from you.

Sincerely,



Helen M. Jenkins, PhD, RN  
Associate Professor

Enclosures



## Appendix B

### CLINICAL DECISION MAKING SCALE

### THE CLINICAL DECISION MAKING SCALE

Adapted from the Clinical Decision Making in Nursing Scale\*  
with permission of  
Helen M. Jenkins, Ph.D., R.N.

\*Copyright 1983

### Directions for the Clinical Decision Making Scale

For each of the following statements, think of your behavior while caring for clients. Answer on the basis of what you are doing now in the clinical setting.

There are no "right" or "wrong" answers. What is important is your assessment of how you ordinarily operate as a decision maker in the clinical setting. None of the statements cover emergency situations.

Statements are listed beginning on the following page. Use the answer sheet provided. Do not dwell on responses. Circle the answer that comes closest to the way you ordinarily behave.

Answer all items. About twenty minutes should be required to complete this exercise.

### Scale for the CDMS

Circle whether you would likely behave in the described way:

A - Always - What you consistently do every time.

F - Frequently - What you usually do most of the time.

O - Occasionally - What you sometimes do on occasion.

S. - Seldom - What you rarely do.

N - Never - What you never do at any time.

Sample Statement: I mentally list options before making a decision.

Key: A   F   O   S   N

The circle around response F means that you usually mentally list options before making a decision.

### **Clinical Decision Making Scale**

Note: Be sure you respond in terms of what you are doing in the clinical setting at the present time.

1. If the clinical decision is vital and there is time, I conduct a thorough search for alternatives.
2. When a person is ill, his or her cultural values and beliefs are secondary to the implementation of health services.
3. The situational factors at the time determine the number of options that I explore before making a decision.
4. Looking for new information in making a decision is more trouble than it's worth.
5. I use books or professional literature to look up things I don't understand.
6. A random approach for looking at options works best for me.
7. Brainstorming is a method I use when thinking of ideas for options.
8. I go out of my way to get as much information as possible to make decisions.
9. I assist clients in exercising their rights to make decisions about their own care.
10. When my values conflict with those of the client, I am objective enough to handle the decision making required for the situation.
11. I listen to or consider expert advice or judgment, even though it may not be the choice I would make.
12. I solve a problem or make a decision without consulting anyone, using information available to me at the time.
13. I don't always take time to examine all the possible consequences of a decision I must make.
14. I consider the future welfare of the family when I make a clinical decision which involves the individual.
15. I have little time or energy available to search for information.

Note: Be sure you respond in terms of what you are doing in the clinical setting at the present time.

16. I mentally list options before making a decision.
17. When examining consequences of options I might choose, I generally think through "If I did this, then ...".
18. I consider even the remotest consequences before making a choice.
19. Consensus among my peer group is important to me in making a decision.
20. I include clients as sources of information.
21. I consider what my peers will say when I think about possible choices I could make.
22. If an instructor recommends an option to a clinical decision making situation, I adopt it rather than searching for other options.
23. If a benefit is really great, I will favor it without looking at all the risks.
24. I search for new information randomly.
25. My past experiences have little to do with how actively I look at risks and benefits for decisions about clients.
26. When examining consequences of options I might choose, I am aware of the positive outcomes for my client.
27. I select options that I have used successfully in similar circumstances in the past.
28. If the risks are serious enough to cause problems, I reject the option.
29. I write out a list of positive and negative consequences when I am evaluating an important clinical decision.
30. I do not ask my peers to suggest options for my clinical decisions.
31. My professional values are inconsistent with my personal values.
32. My finding of alternatives seems to be largely a matter of luck.

Note: Be sure you respond in terms of what you are doing in the clinical setting at the present time.

33. In the clinical setting I keep in mind the course objectives for the day's experience.
34. The risks and benefits are the farthest thing from my mind when I have to make a decision.
35. When I have a clinical decision to make, I consider the institutional priorities and standards.
36. I involve others in my decision making only if the situation calls for it.
37. In my search for options, I include even those that might be thought of as "far out" or non-feasible.
38. Finding out about the client's objectives is a regular part of my clinical decision making.
39. I examine the risks and benefits only for consequences that have serious implications.
40. The client's values have to be consistent with my own, in order for me to make a good decision.

Thank you for being a participant in this study. Do you have any ideas about decision making in physical therapy that were not covered by the scale that you would like to share? You can speak to specific items or give any general comments you would like. Feel free to use this last page or the back of the answer sheet.

## Answer Sheet for the Clinical Decision Making Scale

Directions: After reading each statement, circle the response which comes closest to the way you act or behave. Please do not skip any of the items.

Remember that:

- A** - Always - What you consistently do every time.
- F** - Frequently - What you usually do most of the time.
- O** - Occasionally - What you sometimes do on occasion.
- S** - Seldom - What you rarely do.
- N** - Never - What you never do at any time.

- |                             |                             |
|-----------------------------|-----------------------------|
| 1.    A    F    O    S    N | 21.   A    F    O    S    N |
| 2.    A    F    O    S    N | 22.   A    F    O    S    N |
| 3.    A    F    O    S    N | 23.   A    F    O    S    N |
| 4.    A    F    O    S    N | 24.   A    F    O    S    N |
| 5.    A    F    O    S    N | 25.   A    F    O    S    N |
| 6.    A    F    O    S    N | 26.   A    F    O    S    N |
| 7.    A    F    O    S    N | 27.   A    F    O    S    N |
| 8.    A    F    O    S    N | 28.   A    F    O    S    N |
| 9.    A    F    O    S    N | 29.   A    F    O    S    N |
| 10.   A    F    O    S    N | 30.   A    F    O    S    N |
| 11.   A    F    O    S    N | 31.   A    F    O    S    N |
| 12.   A    F    O    S    N | 32.   A    F    O    S    N |
| 13.   A    F    O    S    N | 33.   A    F    O    S    N |
| 14.   A    F    O    S    N | 34.   A    F    O    S    N |
| 15.   A    F    O    S    N | 35.   A    F    O    S    N |
| 16.   A    F    O    S    N | 36.   A    F    O    S    N |
| 17.   A    F    O    S    N | 37.   A    F    O    S    N |
| 18.   A    F    O    S    N | 38.   A    F    O    S    N |
| 19.   A    F    O    S    N | 39.   A    F    O    S    N |
| 20.   A    F    O    S    N | 40.   A    F    O    S    N |

## Appendix C

## STUDENT/GRADUATE DEMOGRAPHIC INFORMATION SHEET

Demographic Information Sheet  
for Physical Therapy Students/GraduatesSex: ☐ Male ☐ FemaleAge:  Years

Level in Program in Physical Therapy: ☐ First year student  
☐ Second year student  
☐ New graduate  
☐ One year post-graduation

Thank you!

## Appendix D

## LETTER TO CLINICAL INSTRUCTORS

May \_\_\_\_, 1995

Dear (Clinical Instructor):

You are invited to participate in a study of the clinical decision making skills of physical therapy students. The purpose of this study is to determine the difference in clinical decision making skills of physical therapy students across a curriculum. You have been selected as a participant in this study because you were recently responsible for supervising one of our students by the name of \_\_\_\_\_.

I understand that you have a very busy schedule and I would be very grateful if you could find approximately ten minutes to participate in this study.

Please complete the enclosed four questions and return them to me in the stamped addressed return envelope within the next two weeks. The number on the attached sheet is for student identification purposes and to determine if the information has been returned. Any information obtained in connection with this study will be held in strict confidence. Any information obtained in this study may be published in appropriate journals or presented at professional meetings. In such publications or presentations, all identification will be kept strictly confidential.

As my sample size is relatively small, you are vitally important to my study. I appreciate you taking a few minutes of your time to respond to my questions. Participation is voluntary. Your decision whether or not to participate will not affect your present or future relationship with the University of Osteopathic Medicine and Health Sciences.

Your completion of this questionnaire indicates that you have read the information above and have elected to participate in this study. If you have any questions, please do not hesitate to contact me at 515/271-1634. Thank you for your time and the courtesy of your assistance.

Sincerely,

M. Susan Cigelman, Ed.S., P.T.  
Director, Program in Physical Therapy



## Appendix E

## CLINICAL INSTRUCTOR QUESTIONNAIRE

Clinical Decision Making Questionnaire  
for Clinical Instructors

1. Clinical Instructor: \_\_\_\_\_ Male \_\_\_\_\_ Female
2. Age: \_\_\_\_\_ years
3. Number of years you have been a physical therapist \_\_\_\_\_  
(Please round to the nearest half year.)

**Clinical decision making** is defined as the process that a health professional utilizes in the clinical setting to make a decision. This includes: using basic thinking processes to choose a best response among several options; assembling information needed in a topic area; comparing advantages and disadvantages of alternative approaches; determining what additional information is required; and judging the most effective response and being able to justify it.

Please rate the physical therapy student from the University of Osteopathic Medicine and Health Sciences that you recently supervised in your clinic. Mark the spot on the scale which comes closest to the way in which the student acted or behaved in relation to the above definition of clinical decision making.

A - Always - What the student consistently did every time.

F - Frequently - What the student usually did most of the time.

O - Occasionally - What the student sometimes did on occasion.

S - Seldom - What the student rarely did.

N - Never - What the student never did at any time.

4. \_\_\_\_\_  
A                      F                      O                      S                      N

Thank you for your assistance! Please return in the enclosed envelope.

## Appendix F

## LETTER TO STUDENT/ALUMNUS

Dear Physical Therapy Student:

You are invited to participate in a study of the clinical decision making skills of physical therapy students. The purpose of this study is to determine the difference in clinical decision making skills of physical therapy students across a curriculum. You have been selected as a possible participant in this study because you are currently enrolled as a student in a physical therapy program. There will be approximately 125 subjects in this study.

If you decide to participate, you will be asked to complete the attached Clinical Decision Making Scale along with a demographic data sheet. The process should take no longer than 30 minutes.

Any information obtained in connection with this study will be held in strict confidence. Any information obtained in this study may be published in appropriate journals or presented at professional meetings. In such publications or presentations, your identification will be kept strictly confidential.

Participation is voluntary. Your decision whether or not to participate will not affect your present or future relationship with the University of Osteopathic Medicine and Health Sciences. If you decide to participate, you are free to withdraw your consent and to discontinue participation at any time.

If you have any questions, please do not hesitate to ask. If you have any questions later or wish to obtain the results of your test, please feel free to contact Susan Cigelman at 515/271-1634. You may keep this sheet of information for your records.

You are voluntarily making a decision whether or not to participate in this research study. Your completion of the attached Clinical Decision Making Scale and demographic data sheet indicates that you have read the information provided above and have elected to participate. You may withdraw at any time without prejudice after completing these forms should you choose to discontinue participation in this study. Thank you for your time and the courtesy of your assistance.

Sincerely,

M. Susan Cigelman, Ed.S., P.T.



Appendix G

NORMAL DISTRIBUTION CALCULATIONS

Variable	<u>s<sub>s</sub></u>	<u>S</u>	<u>z</u>
Class of 1994			
Total CDMS	0.41	0.57	1.39
Subscale A	0.41	1.16	2.82*
Subscale B	0.41	0.37	0.90
Subscale C	0.41	0.23	0.56
Subscale D	0.41	0.54	1.32
Class of 1995			
Grade Point Ave.	0.39	-0.21	-0.54
Total CDMS	0.39	0.06	0.15
Subscale A	0.39	0.33	0.85
Subscale B	0.39	0.11	0.28
Subscale C	0.39	-0.16	-0.41
Subscale D	0.39	-0.08	-0.21
CI Rating Scale	0.39	-0.48	-1.23
Class of 1996			
Grade Point Ave.	0.37	-1.03	-2.78*
Total CDMS	0.37	0.22	0.59
Subscale A	0.37	-0.46	-1.24
Subscale B	0.37	0.64	1.73
Subscale C	0.37	0.07	0.19
Subscale D	0.37	0.56	1.51
CI Rating Scale	0.37	-0.95	-2.57
Classes of 1995 and 1996			
Grade Point Ave.	0.27	-0.61	-2.26
Total CDMS	0.27	0.14	0.52
CI Scores	0.27	-0.71	-2.63*
(Extrapolated)			
Class of 1997 Pre-Test			
Total CDMS	0.37	0.20	0.54
Subscale A	0.37	0.13	0.35
Subscale B	0.37	0.19	0.51
Subscale C	0.37	-0.27	-0.73
Subscale D	0.37	-0.66	-1.78
Class of 1997 Post-Test			
Total CDMS	0.38	-0.01	-0.03
Subscale A	0.38	0.21	0.55
Subscale B	0.38	-0.42	-1.11
Subscale C	0.38	0.24	0.63
Subscale D	0.38	0.14	0.37

\*(alpha = 0.01) z = + 2.58

s<sub>s</sub> = square root of 6/N

z = (S - 0) / s<sub>s</sub>

## Appendix H

## HOMOGENEITY OF VARIANCE CALCULATIONS

$\underline{F}_{\max}$  = largest sample variance/smallest sample variance

## Null Hypothesis One

$$\underline{F}_{\max} = 129.75/76.57 = 1.69$$

$$\alpha = 0.05, k = 4, df = 34, cv = 2.61$$

Homogeneity of variance assumption not violated

## Null Hypothesis Two

$$\underline{F}_{\max} = 100.94/69.28 = 1.46$$

$$\alpha = 0.05, k = 2, df = 40, cv = 1.94$$

Homogeneity of variance assumption not violated

## Null Hypothesis Five

$$\underline{F}_{\max} = 510.21/76.18 = 6.7$$

$$\alpha = 0.05, k = 2, df = 81, cv = 1.67$$

Homogeneity of variance assumption violated